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REMARKS

Claims 11 and 12 stand rejected upon informalities and claims 8-14 stand rejected on prior art grounds. Applicants respectfully traverse these rejections based on the following discussion. Additionally, claims 35-47 are newly added and are similar to previously cancelled claims 1-7 and 29-34. No matter is being added, and examination is respectfully requested. Thus, claims 8-14 and 35-47 are all the claims presently pending in the application.

I. The 35 U.S.C. §112, Second Paragraph Rejection

Claims 11 and 12 were rejected as being indefinite for failing to particularly point out and distinctly claim the subject matter of the invention.

Specifically, claim 11 was rejected for included several terms without antecedent bases. Thus, claim 11 is amended herein to read "said epitaxial silicon halo layer" vice "said epitaxial silicon panel layer" and also to read "said gate stack" vice "said gate conductor."

Claim 12 was rejected because "it is unclear what dopant would constitute halo dopant since the specification does not specify it, for examination purpose, any dopant would be considered a halo dopant." The Applicants respectfully disagree. Paragraph [0007] of the specification indicates that "the halo layer has the opposite doping of the epitaxial silicon source/drain layer". Furthermore, paragraph [0027] specifically provides examples of the types of dopants that may be used (i.e., "For example, Arsenic (As) or Phosphorus can be used for NFET extensions or source drains and boron (B) or indium (In) can be used for NFET halos. For example, Boron or BF2 can be used for PFET extensions or source drains whereas As or P can be used for PFET halos.") However, to clarify this issue claim 12 is amended herein to specify

"wherein said halo dopants are different from said source/drain dopants".

II. The Prior Art Rejections

Claims 8-10 stand rejected under 35 U.S.C. 102(b) as being anticipated by Hite et al. (U.S. Patent No. 4,863,878), hereinafter referred to as Hite. Claims 11-14 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Hite in view of Noguchi et al. (U.S. Publication No. 2004/0135210), hereinafter referred to as Noguchi. Applicants respectfully traverse these rejections based on the following discussion.

A. Rejection Of Independent Claim 8 Based On Hite

More particularly, the Applicants submit that Hite does not teach or suggest the following features of amended independent claim 8: (1) "wherein the top surface of said silicon substrate has an increased oxygen content when compared to other portions of said silicon substrate"; and (2) "an epitaxial silicon halo layer on said top surface of said silicon substrate".

Specifically, Hite discloses methods of forming silicon on insulator (SOI) structures. The background section of Hite (see col. 1, line 40-col. 2, line 2 and Figures 1A-1D) discusses a prior art method of forming a SOI structure. Specifically, oxygen ions are implanted into a silicon substrate 1 with an energy sufficient to cause implantation below the top surface of the substrate. During this implant process, the oxygen ions react with the substrate to form a silicon dioxide layer 3 below a crystalline silicon layer 5 of the substrate. The structure is then subjected to a high temperature anneal in order to anneal the damage caused to the crystalline silicon layer 5 and to provide a good base for forming an crystalline epitaxial layer 7 on the surface of the

crystalline silicon layer 5.

Hite's invention is similar to this prior art process but eliminates the anneal process (see col. 2, line 40-col. 3 line 16). Specifically, Hite indicates that the structure of Fig. 1D is susceptible to radiation effects and discloses that omitting the anneal step has some advantageous results. That is, Hite's invention discloses that a silicon substrate 21 undergoes a high dose, high energy oxide ion implant (e.g., 150 keV-200keV and 1.1 x 10^{18}/cm_2 - 2.2 x 10^{18}/cm^2) such that a buried silicon dioxide layer 23 is formed below a silicon surface 25. The temperatures during the implant are kept between 400 and 600 degrees so as to maintain the crystallinity of the silicon surface 25. The anneal step is omitted and an epitaxial layer 27 is grown by CVD on the single crystalline silicon surface 25.

Contrarily, the present invention does not teach or suggest the formation of a silicon on insulator structure. Rather, in the present structure the substrate is oxidized, e.g., by using a low dose, low energy implant (e.g., 0.1keV -20keV and 1.1 x 10^{15}/cm_2 - 2.2 x 10^{17}/cm^2) such that only the top surface (e.g., the top 50%, the top 10%, the top 1%) of the substrate is oxidized and this top has a higher oxygen content than other portions of the substrate. However, the oxygen content is still below an amount that would prevent epitaxial growth. (see paragraphs [0022]-[0023]). The structure further comprises an eptiaxial silicon layer grown from the top surface of the substrate. This epitaxial silicon layer can include an epitaxial silicon halo layer directly on the top surface and an epitaxial silicon source/drain layer on the eptiaxial silicon halo layer (see paragraph [0031]). The oxygen content in top surface of the substrate limits dopants within the epitaxial silicon layer from moving into the silicon substrate so that the junction depth is limited by the epitaxial silicon thickness (see paragraph [0027]).

The Office Action provides that Hite teaches "a silicon substrate 1, wherein the top surface of said silicon substrate has an increased oxygen content when compared to other portions of said silicon substrate, and wherein said oxygen content of said top surface of said silicon substrate is below an amount that would prevent epitaxial growth (see epitaxial layer 7 or 27) is able to grow thereon." The Applicant's respectfully disagree. As discussed above, in both the prior art discussed in the background section of Hite and in Hite's invention, the top surface of the substrate is a crystalline silicon layer (see item 5 of Figure 1A or item 25 of Figure 2A) with a buried oxide layer underneath (see item 3 of Figure 1A or item 23 of Figure 2A). Thus, the crystalline silicon layer 5, 25 at the top of the substrate has less oxygen content than the buried oxide layer 3, 25 deeper within the substrate (due to the high energy, high dose implant process). No where does Hite teach or suggest that the top surface of the silicon substrate has an increased oxygen content when compared to other portions of the silicon substrate, but still below an amount that would prevent epitaxial growth.

Additionally, while the subsequent figures (i.e., see Figures 1B-1D and 2B-2D, respectively) do not continue to show items 5 and 25, respectively, after the epitaxy process is performed, this silicon layer 5, 25 is not removed. That is, the epitaxial layer 7 of Figure 1B or 27 of Figure 2B is grown directly from the crystalline silicon layer 5 or 25 such that the layer 5, 25 remains. The epitaxy layer is not grown from and, thus, is not directly an oxide surface (see col. 1, lines 49-52 and col. 3, lines 1-13).

The Office Action further provides that Hite discloses "A silicon halo layer 5 on said top surface of said silicon substrate". The Applicants respectfully disagree. As mentioned above item 5 of Hite refers to the crystalline silicon layer 5 that is present in the substrate above the

buried oxide layer 3 following a high energy implant process. Thus, layer 5 is not "on" the top surface of the silicon substrate but rather includes the top surface of the silicon substrate. Furthermore, no where in Hite does it teach or disclose the formation of a halo layer.

Therefore, amended independent claim 8 is patentable over Hite. Further, dependent claims 9-14 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

B. Discussion Of Newly Added Independent Claims 35 and 42

The Applicants further submit that Hite does not teach or suggest the following features of newly added independent claim 35: (1) "wherein the top surface of said silicon substrate has an increased oxygen content when compared to other portions of said silicon substrate"; and (2) "wherein said dopants are substantially limited to said epitaxial silicon layer by said increased oxygen content of said top surface of said silicon substrate." Hite also does not teach the similar features found in newly added independent claim 42.

Specifically, the Applicants submit that Hite does not teach or suggest the feature of "wherein the top surface of said silicon substrate has an increased oxygen content when compared to other portions of said silicon substrate" for the same reasons as set out above with regard to independent claim 8.

Additionally, features similar to "wherein said dopants are substantially limited to said epitaxial silicon layer by said increased oxygen content of said top surface of said silicon substrate" are presented in dependent claims 9 and 10. The Office Action provides that Hite teaches "the source/drain dopants are substantially limited to the silicon source/drain layer. See figs. 1A-1D and 2A-2D) and associated text" and further indicated that "the increased oxygen content would inherently limit dopants within the silicon layer from moving into the silicon substrate". The Applicants respectfully disagree.

Again, as discussed above, the top portion 5 (see Figure 1A) or 25 (see Figure 2A) of the substrate of Hite is a crystalline silicon and that crystalline silicon is above a buried oxide layer 3, 23. The buried oxide layer 3, 23 would inherently prevent dopants from diffusing deeper into the substrate. However, after the epitaxial layer 7, 27 is grown from the crystalline silicon top surface, dopants implanted into the epitaxial layer 7, 27 of Hite would not be limited to the epitaxial layer (i.e., would not be limited from diffusing into the crystalline silicon top portion 5, 25 of the substrate).

Therefore, newly added independent claims 35 and 42 are patentable over Hite. Further, dependent claims 36-41 and 43-47 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

III. Formal Matters and Conclusion

In view of the foregoing, Applicants submit that claims 8-14 and 35-47, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0458.

Respectfully submitted,

Dated: 1/10/07

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